DR. BRR GOVT DEGREE COLLEGE, JADCHERLA

MAHABUBNAGAR, Dist TELANAGANA

Dept of Sciences

Student study project

"A STUDY ON DIAMETER OF HUMAN HAIR"

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❖ CERTIFICATE

This is to certify that the project work entitled **'A STUDY ON DIAMETER OF HUMAN HAIR,Dr. BRR Government Degree College ,Jadcherla, Mahabubnagar District, Telangana."** is a bonafide work done by the students of III MPCs (EM).**N.RANGA SWAMY, B. RAVI TEJA, T. KARTHIK, G.SAI KISHOR, J.RAKESH**under my supervision for the award of Project Work in Physics, Department of Physics, Dr. BRR Government College, Jadcherla and the work hasn't been submitted to any other College/University either in part nor in full, for the award of any degree.s

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DECLARATION

Wehereby declare that the project work entitled with **"A STUDY ON DIAMETER OF HUMAN HAIR "**is a genuine work done by us under the supervision of**UdayKumar**, for the Department of Physics, Dr. BRR Government College, and it has not been under the submission to any other Institute/University either in part nor in full, for the award of any degree.

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➢ INTRODUCTION:

Hair is a component of the integumentary system and extends downward into the dermal layer where it sits in the hair follicle. The presence of hair is a primary differentiator of mammals as a unique class of organisms. In humans, it is a cherished and highly visible indicator of health, youth, and even class. It has a sensory function, protects from cold and UV radiation, and can have a significant psychological impact when its growth or structure is deranged. At a microscopic level, the variety in length, color, diameter, and cross-sectional shape of each hair creates the characteristic profiles seen across ethnic groups and among individuals. This article will discuss the physiology of hair, cellular components, mechanisms of growth and differentiation, and its clinical significance

1.Brief overview of the importance of hair diameter in various contexts.Explanation of the structure of human hair and the factors influencing its diameter.

2. Measurement Techniques:

- Microscopic Measurement: Discusses the use of optical microscopes, scanning electron microscopes (SEM), and transmission electron microscopes (TEM) for precise hair diameter measurement.
- Image Analysis: Explores computer-based techniques such as image processing and morphometric analysis for automated hair diameter measurement.
- Other Methods: Briefly mentions alternative methods like laser diffraction and light scattering.

3. Factors Affecting Hair Diameter:

- Genetic Factors: Examines the impact of genetics on hair diameter and discusses studies investigating hereditary variations.

- Hormonal Influences: Discusses the role of hormones, particularly androgens, in hair diameter variations, with a focus on studies related to androgenetic alopecia.

- Age and Gender: Reviews research on the changes in hair diameter during aging and the differences between males and females.

- Environmental and Lifestyle Factors: Explores the effects of external factors such as UV radiation, pollution, and hair care practices on hair diameter.

4. Hair Diameter in Cosmetology and Hair Care:

- Hair Texture Classification: Describes the use of hair diameter as a criterion for categorizing hair types (e.g., fine, medium, coarse) in the field of cosmetology.

- Hair Products and Treatments: Examines the influence of hair diameter on the efficacy of various hair care products, including shampoos, conditioners, and styling agents.

5. Hair Diameter in Dermatology and Medical Sciences:

- Alopecia Research: Discusses the relationship between hair diameter and hair loss conditions, such as androgenetic alopecia and alopecia areata.

- Dermatological Disorders: Reviews studies exploring the association between hair diameter and certain skin conditions like hirsutism and hypertrichosis.

- Drug Testing and Forensic Analysis: Highlights the forensic applications of hair diameter analysis in drug testing, crime investigation, and identifying individuals.

6. Future Directions and Conclusion:

- Discusses potential areas for future research, such as investigating the influence of dietary factors and the development of non-invasive measurement techniques.

- Concludes with a summary of key findings and the overall significance of hair diameter in various disciplines.

This review provides a comprehensive overview of the literature on hair diameter, highlighting its importance in different fields. The understanding of hair diameter and its influencing factors can contribute to advancements in hair care, medical diagnosis, and forensic investigations, ultimately benefiting various aspects of human life.

➢ REVIEW OF LITERATURE:

Hair diameter is an important characteristic of human hair and plays a significant role in various fields, including cosmetology, dermatology, and forensic science. This review of literature aims to summarize the existing research on hair diameter, its measurement techniques, factors influencing diamseter, and its implications in different disciplines.

➢ Laser Diffraction: Laser diffraction is a technique that measures the scattering pattern of a laser beam as it passes through a hair strand. The scattering pattern is analyzed to determine the diameter of the hair. This method is often used for measuring the average diameter of a large number of hair strands quickly.

➢ Interferometry: Interferometry is a method that uses interference patterns to measure the diameter of objects, including human hair. In this technique, a hair strand is placed in an interferometer, and the interference patterns resulting from the interaction of light waves passing through the hair are analyzed. The diameter can be calculated based on these patterns.

➢ OBJECTIVES:

➢ The objectives related to studying the diameter of human hair can vary depending on the specific field or application. Here are some common objectives associated with studying hair diameter:

➢ To find the diameter of human hair of 3rd year mpcs students

➢ MATERIALS & METHODOLOGY

To conduct an experiment to measure the diameter of hair using laser lightWe will need the following materials:

1.Hair Samples: Obtain a sample of hair strands for measurement. It is advisable to use hair strands of similar type (e.g., human hair,) and ensure they are clean and free from any external substances.

2. Laser Source: Use a laser that emits a thin, collimated beam of light. A laser pointer or a laser diode module can be suitable for this purpose. Ensure the laser is safe and follows appropriate laser safety guidelines.

3. Mounting Setup: Prepare a stable setup to hold the hair strands and position the laser source. This setup should allow precise alignment of the laser beam with the hair strands.

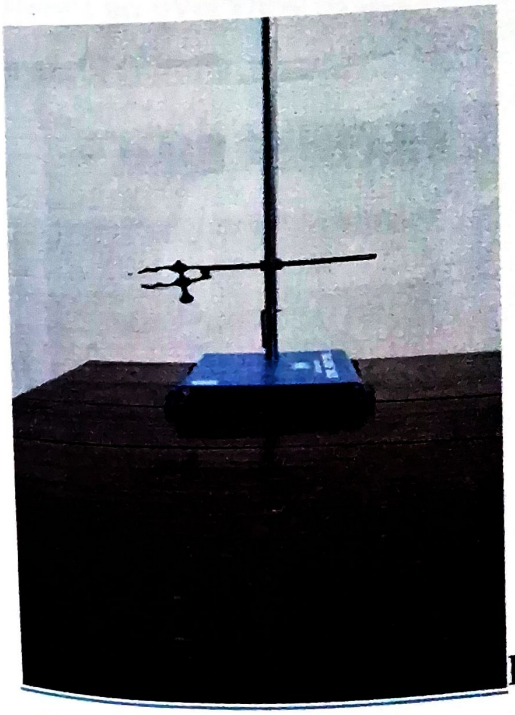
4. Screen or Surface: Place a screen or a white surface behind the hair strands to visualize the interaction of the laser beam with the hair. This will help observe the laser beam's behavior and any changes caused by the hair strands.

5. Calibration Reference: Use a known reference with a known width to calibrate the laser beam diameter. This can be a thin wire or a glass slide with a known dimension. The reference should be placed in the same setup as the hair strands for calibration.

6. Data Recording Tools: Prepare a notebook, spreadsheet, or data recording software to document and organize the measured data during the experiment. Ensure you have a systematic approach to record observations accurately.

7. Safety Equipment: It is crucial to prioritize safety during the experiment. Depending on the laser used, safety glasses or other appropriate laser safety equipment might be necessary

- **STAND INSTRUCTOR:**



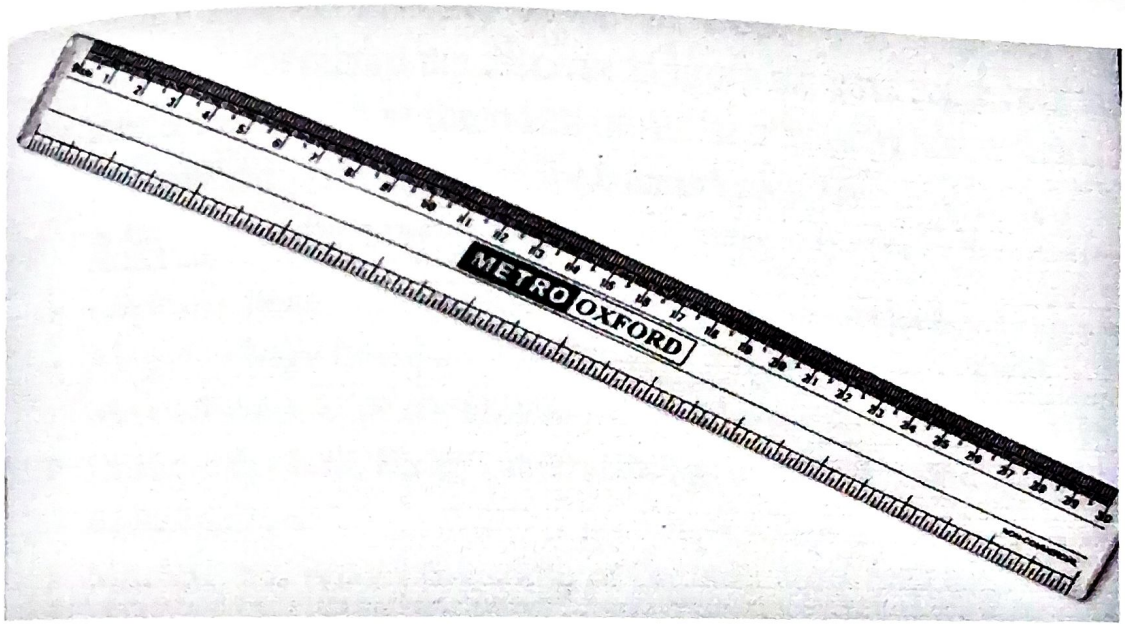
LASER LIGHT :

Laser light can be utilized in measuring the diameter of human hair using various techniques. One such technique is laser diffraction, which involves the interaction of laser light with the hair sample to determine its diameter. Here's an overview of the methodology using laser light for hair diameter measurement.

- **HAIR SAMPLES**

Hair samples are collected and used for various purposes, including research, analysis, diagnostics, and forensic investigations. Here's some information about hair samples:

SCALE:



The use of a scale is important in measuring the diameter of human hair as it provides a reference for accurate measurements. Here's how a scale can be used in the context of hair diameter measurement

➢ METHODOLGY:

➢ To conduct a study on the diameter of hair using laser light, We can follow the experimental methodology outlined below:

1. Experimental Setup:

➢ Obtain a sample of hair strands to be measured. Ensure they are clean and free from any external substances.

➢ Set up a laser source that emits a thin, collimated beam of light. A laser pointer or laser diode module can be suitable for this purpose.

➢ Position the laser source in a stable manner, ensuring that the beam is perpendicular to the hair strands.

➢ Place a screen or a white surface behind the hair strands to visualize the laser beam's interaction with the hair.

2.Calibration:

- Start by calibrating the laser beam diameter using a known reference. You can use a thin wire or a glass slide with a known width.
- Adjust the distance between the laser source and the reference until the beam's diameter matches the known width.
- Measure and record the distance between the laser source and the reference, as well as the width of the laser beam at that distance. This information will be crucial for later calculations.

3.Measurement:

- Carefully place a single hair strand on a clean surface.
- Align the laser beam so that it passes through the hair strand perpendicularly, preferably at its thickest point.
- Observe the laser beam's interaction with the hair strand on the screen or white surface.
- Measure and record the width of the laser beam both before and after it interacts with the hair strand. Ensure you measure the beam at the same distance as during calibration.
- Repeat the measurement process for multiple hair strands to ensure accuracy and collect a sufficient sample size.

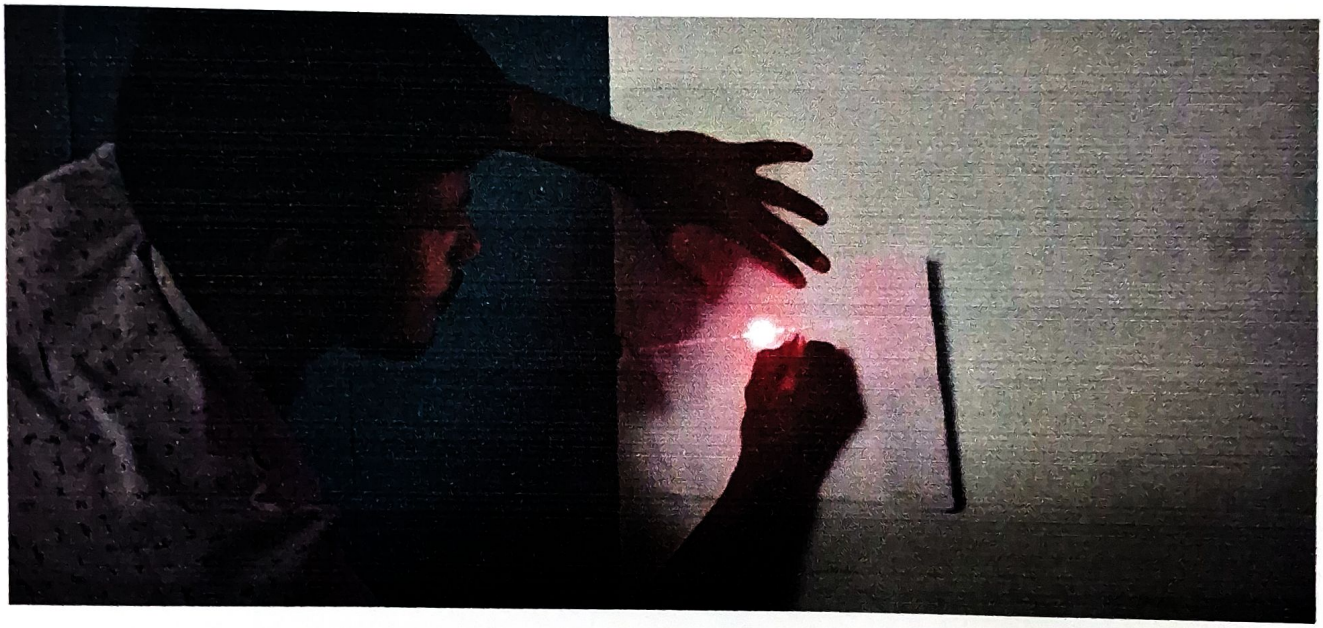
Data Analysis:

- Calculate the difference in beam width before and after interaction with the hair strand for each measurement.
- Subtract the known width of the laser beam (from calibration) from the measured difference to obtain the effective diameter of the hair strand.
- Calculate the average diameter and standard deviation of the hair strands using the recorded measurements.
- Analyze the data and draw conclusions regarding the diameter distribution of the hair strands.

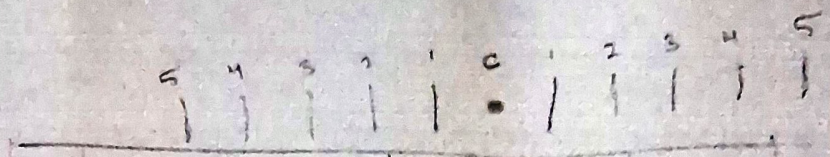
Considerations:

- Ensure that the laser used is safe and follows appropriate laser safety guidelines.
- Minimize external sources of light that could interfere with the laser beam and hair strand interaction.
- Remember to document your experimental procedures, observations, and data accurately for later reference and potential replication by others.

➢ MAKING PROCESS:



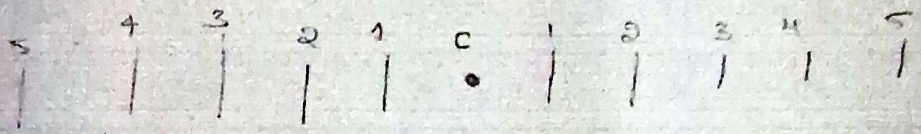
RESULTS:



S.NO	Order of minimas(n)	Dist of band from central maxima 'd'cm	Distance b/w screen and hair. 'D'cm	Sin θ = d/D	Diameter of hair 'a' in cm
1	1	1cm	180cm	0.005	0.011
2	2	2.2cm		0.012	0.0049
3	3	3.25cm		0.018	0.0035
4	4	4.4cm		0.024	0.0024

a = 0.0197

Pathaj



S.NO	Order of minimas(n)	Dist of band from central maxima 'd'cm	Distance b/w Screen and hair 'D'cm	Sin θ = d/D	Diameter of hair 'a' in cm
1	1	1.45 cm	180cm	0.008	0.007
2	2	2.9 cm		0.016	0.003
3	3	4.4cm		0.024	0.002
4	4	5.85		0.032	0.001

a = 0.01885

S No	order of minimum (n)	Distance of bend from central maxima d cm	Distance b/w screen and hair D cm	Sin θ = d/D	Diameter of hair 'a' in cm
1	1	2 cm	15 cm	0.005	0.0117
2	2	4.1 cm		0.0113	0.005
3	3	6.3 cm		0.0175	0.0033
4	4	8.5 cm		0.236	0.0002

a = 0.00005

S No	order of minimum (n)	Distance of bend from central maxima d cm	Distance b/w screen and hair D cm	Sin θ = d/D	Diameter of hair 'a' in cm
1	1	2.5 cm	150 cm	0.0069	0.0085
2	2	4.7 cm		0.0125	0.0047
3	3	6.5 cm		0.0188	0.0031
4	4	9.5 cm		0.0272	0.0021

a = 0.01688

S No	order of minimum (n)	Dist of bend from central maxima d cm	Distance b/w screen and hair D cm	Sin θ = d/D	Diameter of hair 'a' in cm
1	1	4.1 cm	180 cm	0.011	0.005
2	2	8.1 cm	180 cm	0.022	0.002
3	3	13.1 cm	180 cm	0.363	0.000

a = 0.007

S No	order of minimum (n)	Dist of bend from central maxima d cm	Distance b/w screen and hair D cm	Sin θ = d/D	Diameter of hair 'a' in cm
1	1	4 cm	180 cm	0.011	0.005
2	2	8.6 cm	180 cm	0.023	0.002
3	3	13.4 cm	180 cm	0.037	0.001
4	4	17.4 cm	180 cm	0.048	0.001

a = 0.00885

4 3 2 1 0 1 2 3 4

S No	order of minimum(n)	Dist of band from Central maximum d cm	Distance b/w Screen and hair D cm	sin θ = d/D	Diameter of hair a in cm
1	1	2.5cm	180cm	0.006	0.009
2	2	5.cm	180cm	0.013	0.004
3	3	7.8cm	180cm	0.021	0.002
4	4	11.6cm	180cm	0.29	0.000

a = 0.015

4 3 2 1 0 1 2 3 4

S No	order of minimum	Distance of band from Central maximum d cm	Distance b/w Screen and hair D cm	sin θ = d/D	Diameter of hair a in cm
1	1	3.2 cm	180 cm	0.008	0.007
2	2	6.4 cm	180 cm	0.017	0.003
3	3	9.7 cm	180 cm	0.026	0.002
4	4	13.5 cm	180 cm	0.037	0.001

a = 0.01005

4 3 2 1 0 1 2 3 4

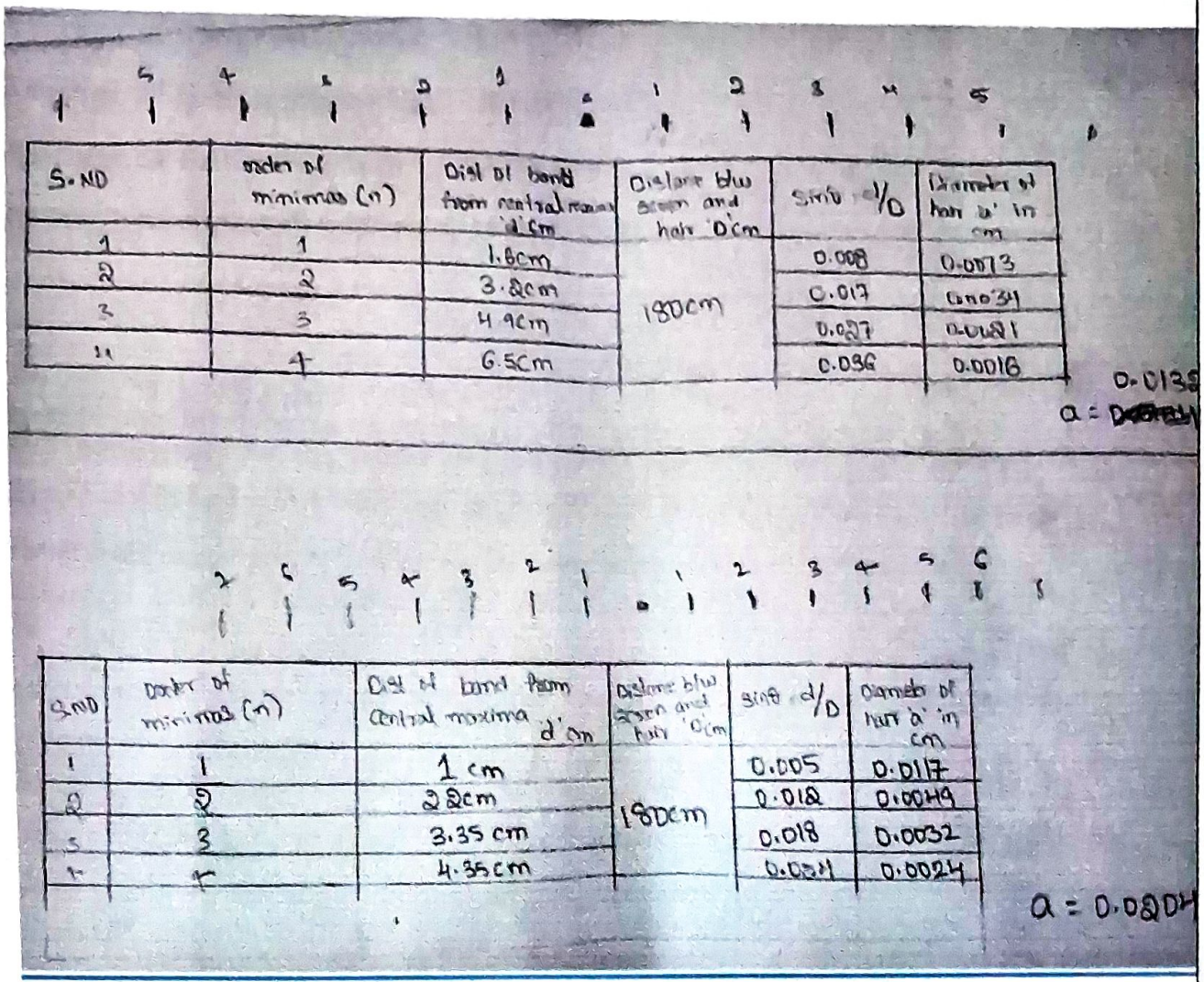
S No	order of minimum(n)	Distance of band from Central maximum d cm	Distance b/w Screen and hair D cm	sin θ = d/D	Diameter of hair a in cm
1	1	2.4 cm	180 cm	0.006	0.0096
2	2	4.7 cm		0.026	0.002
3	3	7.4 cm		0.041	0.014
4	4	10 cm		0.055	0.001

a = 0.00605

4 3 2 1 0 1 2 3 4

S NO	order of minimum	Distance of band from Central maximum d cm	Distance b/w Screen and hair D cm	sin θ = d/D	Diameter of hair a in cm
1	1	2.5cm	180 cm	0.006	0.009
2	2	5.4cm		0.015	0.003
3	3	8.cm		0.022	0.002
4	4	10.5cm		0.027	0.002

a = 0.0145



S.NO	order of minimas (n)	Dist of band from central maxima 'd' cm	Distance b/w screen and hair 'D' cm	sinθ d/D	Diameter of hair 'a' in cm
1	1	1.6cm	180cm	0.008	0.0073
2	2	3.2cm		0.017	0.0034
3	3	4.9cm		0.027	0.0021
4	4	6.5cm		0.036	0.0016

0.0132

a = [illegible]

S.NO	Order of minimas (n)	Dist of band from central maxima 'd' cm	Distance b/w screen and hair 'D' cm	sinθ d/D	Diameter of hair 'a' in cm
1	1	1 cm	180cm	0.005	0.0117
2	2	2.2cm		0.012	0.0049
3	3	3.35 cm		0.018	0.0032
4	4	4.35cm		0.024	0.0024

a = 0.0204

Average of first system A= 0.132

Average of second system A= 0.00204

Average of third system A=0.02605

Average of fourth system A=0.0145

Average of fifth system A=0.015

Average of sixth system A=0.01225

Average of seventh system A=0.01755

Average of eighth system A=0.0152

Average of ninth system A=0.02025

Average of tenth system A=0.0195

Average of eleventh system A=0.007

Average of twelth system A=0.00825

Average of thirteenth system A=0.02005

Average of fourteenth system A=0.001682

Average of fifteenthsystem A=0.0197

Average of sixteenth system A=0.01225

CONCLUSION:

In conclusion, the diameter of human diameter of III rdyear for Bsc studentswere found that has implications in various fields, including cosmetology, medical diagnostics, research on hair biology, and forensic science. Measuring the diameter of human hair allows for classification, understanding of hair growth patterns, development of hair care products, identification of certain medical conditions, and forensic investigations.

1.The methodology for measuring hair diameter typically involves sample selection, preparation, optical microscopy measurement, and data analysis. Various techniques such as direct measurement using a calibrated eyepiece or image analysis with specialized software can be employed. The use of a scale or reference object is crucial for accurate measurements, providing a reliable reference for hair diameter calculations.

2.The diameter of human hair is not only influenced by genetic factors but also impacted by external factors such as hair care practices, age, and overall health. Studying hair diameter provides insights into hair health, potential hair disorders, and the effects of various treatments or products.

3.By studying the diameter of human hair, researchers and professionals in relevant fields can advance their understanding of hair biology, develop tailored hair care products, diagnose and monitor hair-related conditions, and utilize hair evidence in forensic investigations.

➢ FUTURE SCOPE :

The future scope of studying the diameter of human hair holds several promising avenues for research and applications. Here are some potential future directions:.

1.Personalized Hair Care: The study of hair diameter can aid in the development of personalized hair care products and regimens. By considering individual variations in hair diameter, texture, and other characteristics, tailored products can be designed to address specific hair needs, promoting optimal hair health and appearance.

2.Medical Diagnostics: Investigating the diameter of human hair may uncover potential associations with certain medical conditions. Identifying variations in hair diameter as a potential biomarker could lead to non-invasive diagnostic methods for conditions such as hormonal imbalances, nutritional deficiencies, and systemic diseases.

3.Hair Transplantation: Understanding the natural hair diameter and its variations can improve the success and aesthetics of hair transplantation procedures. By considering the donor and recipient hair diameter compatibility, surgeons can achieve more natural-looking results and better patient satisfaction.

4.Forensic Analysis: Hair diameter measurements can continue to play a crucial role in forensic investigations. Advancements in measurement techniques, statistical analysis, and database development can enhance the accuracy and reliability of using hair diameter as a tool for individual identification or linking individuals to crime scenes.

5.As technology advances and our understanding of hair biology deepens, the scope for investigating the diameter of human hair will likely expand furthe5. As technology advances and our understanding of hair biology deepens, the scope for investigating the diameter of human hair will likely expand further.

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